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ABSTRACT

The purpose of this study was to determine whether familiarity was a significant factor in increased cognitive synthesis scores and to conduct a comparison of the training methods employed on the basis of the test score patterns. Previous studies had revealed that symbolic representation was important, but they had not clarified the ways in which such development was facilitated. Fifty-six kindergarten children were randomly assigned to one of four training conditions--Familiarity, Learning Set A, Learning Set B, Control. Each student was pretested on tasks devised by Farnham-Diggory, and posttested for transfer of cognitive synthesis. Results show that "familiarity" is the most probable cause of increased cognitive synthesis scores and that use of a transfer task as a measure of learning is important. Hall's method of direct instruction was found to result in an apparent, surface understanding. It was cautioned that this condition might result in an overestimation of the effects of teaching, and in the long run, be detrimental to the teacher's attempts to provide a suitable learning environment. (CS)

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Abstract

Familiarity as a Factor in Cognitive Synthesis Tasks[1]

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1974

The effect of familiarity was investigated as a possible factor in increased cognitive synthesis scores which were reported after training by both Farnham-Diggory (1970) and Hall, Salvi, Seggev and Caldwell (1970).

To test for the effect of familiarity, 56 kindergarten children were pretested on tasks devised by Farnham-Diggory, trained in four conditions (a) Familiarity; (b) Learning set A; (c) Learning set B and (d) Control; and posttested for transfer of cognitive synthesis. The Wilcoxon test indicated that familiarity was a significant factor in the gains shown. A Kruskal-Wallis analysis showed no significant differences between treatments based on creating a learning set devised by Hall et al. and treatment based on creating conditions leading to spontaneous synthesis devised by Farnham-Diggory.

Different score patterns during training designed to create a learning set and training designed to lead to spontaneous synthesis were noted.

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[1]Paper presented at the meeting of the American Educational Research Association, Chicago, April, 1974.

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Familiarity as a Factor in Cognitive Synthesis Tasks

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1974

The ability to let a toy, a picture, or a graphic form embody or represent another content--the capacity for symbolic representation--is not present at birth but is the outcome of a long process of development. This capacity for representation is crucial to human development and is required for adequate functioning in our world of symbols. Its development in children has received increasing attention in contemporary behavioral science (Franklin, 1973).

The development of symbolic capacities is treated theoretically by Werner (1940), Werner and Kaplan (1963), Piaget (1969,1970), and by Bruner (1966).

Experiments (Klapper and Birch,1969; Ryan, Hegion and Flavell, 1970; Sigel and McBane, 1967; Sigel and Anderson, 1966; Sigel and Olmstead, 1971). suggest that pictured materials which were easily recognized and named by preschool children were not always treated as the equivalent of the real objects in problems requiring complex thinking. However Sigel (1953) reported that by age 7 lower-class boys treated toys, pictures of the toys, and the printed names of the toys as

equivalent stimuli in classification tasks.

Farnham-Diggory (1967, 1970) studied the combining or organizing of symbols into units, a process she called symbol synthesis. She investigated the child's ability to enact words, pictorial symbols, and logographs--whole word symbols--in isolation and then in meaningful, sentence units in an experimental "reading" task. The pictographs and logographs are shown in Figures 1 and 2. She demonstrated that children aged 6 and older had no difficulty performing the actions for 8 common words such as "clap","around", "jump" and "block" and then learning individual pictographs and logographs for these same words.

After children learned the logographs singly, the experimenter constructed a series of 8 two- and three-word sentences, formed by overlapping the logograph cards so that a connection between the symbols was suggested. The child was instructed to read it and then asked, "Now let me see you do it." Farnham-Diggory's results showed that normal children under age 7 could not reliably demonstrate in action the synthesis of the individual logographs into a sentence. Until this age a child who easily learned and read off symbols for "jump", "over", and "block" would continue to act out the words separately, indicating a disjoint concept, rather than integrate them into a synthesized concept, "jump over block." The results also showed a lag for brain damaged

children, who did not demonstrate synthesis until age 13, suggesting a neurological, developmental basis for cognitive synthesis capacities.

Hall, Calvi, Seeney and Caldwell (1970) hypothesized that failure of Farnham-Diggory's subjects on the logograph synthesis task was not due to developmental immaturity but to factors within her testing procedures which produced a set to respond to logographs singly. So Hall and his associates suggested that an explanation based on neurological, developmental principles was not sufficiently parsimonious. They then developed training methods for children aged 3-0 to 4-11 designed to develop a set to respond to 2 or 3 logographs as a unit, using direct teaching--telling and demonstrating the correct answers to the subjects, reinforcement, and giving knowledge of results. This method produced significantly higher scores for their experimental group. However no measure of transfer of training was obtained, a method often used to test for the presence of a learning set.

Meanwhile Farnham-Diggory in a second study (1970) also showed significant gains with kindergarteners using training intended to produce the associations necessary for what she termed spontaneous coordination of information. Her methods included overlearning the actions depicted and repeated "reading" of the individual symbols prior to asking the children to read the symbol sentences and to synthesize the sentences into action spontaneously. Farnham-Diggory theorized that

...activity leading to an internal reorganization was an important factor in learning, as opposed to the effects of ...ready-made solutions to the child.

Both Farnham-Diggory and Hall et al. had produced increased scores easily, in brief training sessions. However neither of their two methods had ruled out simple familiarity--frequency of exposure--as an explanation for their success. In the present study it was hypothesized that the gains obtained by these previous investigators were due primarily to increased familiarity with the isomorphs, not to learning set training, per se, or to training for spontaneous synthesis. Until familiarity was controlled, comparison of the two experimental methods and their respective underlying theoretical viewpoints might be misleading.

Objectives

The purpose of this study was to determine whether familiarity was a significant factor in increased cognitive synthesis scores reported as a result of training on symbol synthesis tasks devised by Farnham-Diggory in experiments by both Farnham-Diggory and Hall, Calvi, Semmes and Caldwell.

Once familiarity was controlled, it was planned to carry out a comparison of the training methods of the two experimenters, as well as an examination of the score patterns resulting from the different training methods.

Method

To test the familiarity hypothesis 2 kindergartens were chosen randomly from a regionalized public school and assigned to

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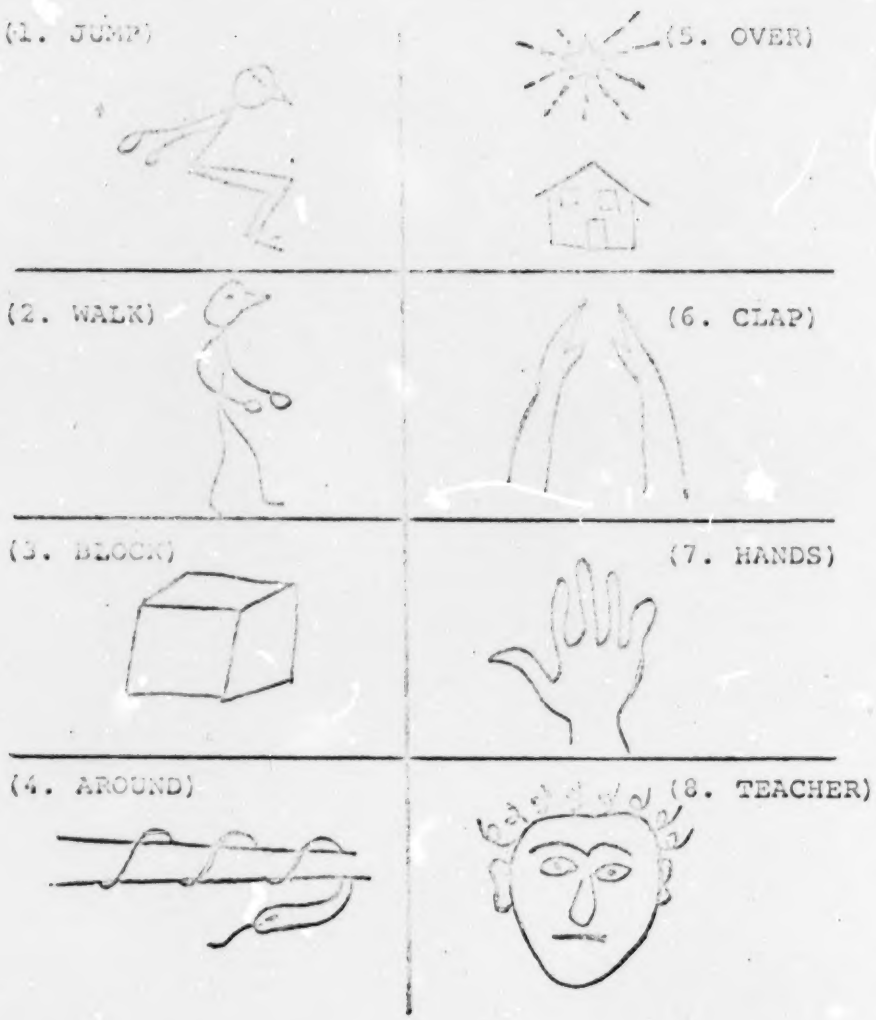

Fig. 1. Pictograph card series. (Words were not printed on the stimulus cards.)

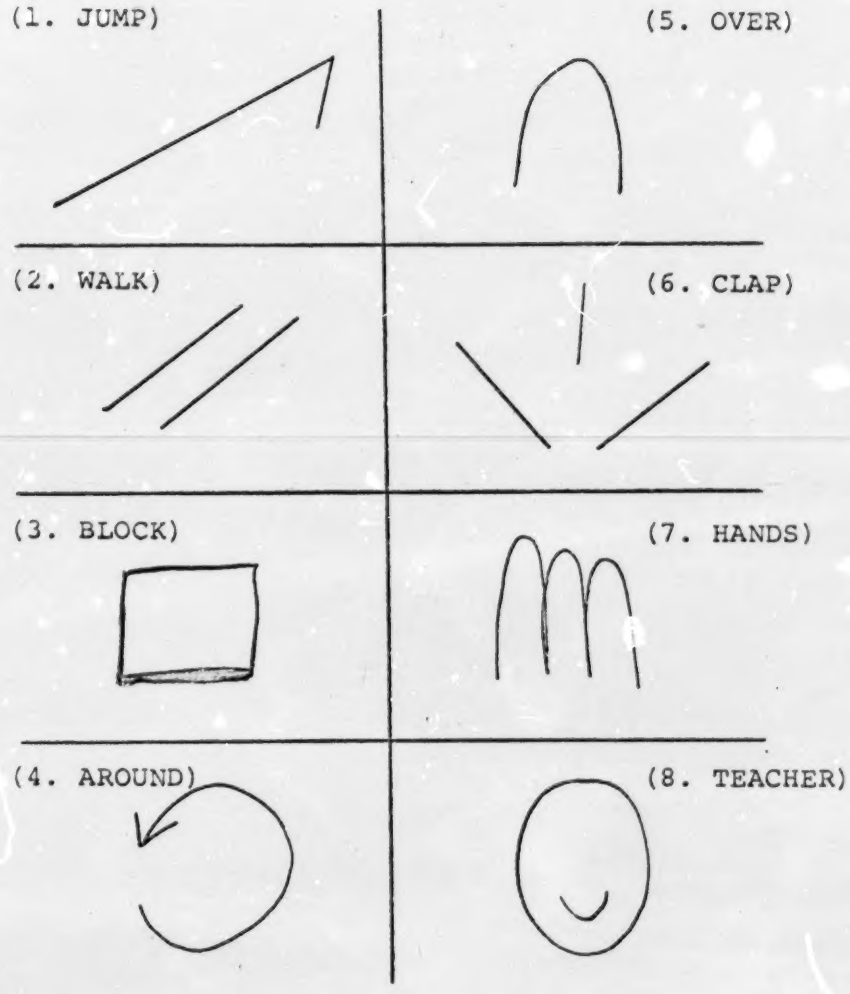

Fig. 2. Logograph card series. (Words were not printed on the stimulus cards.)

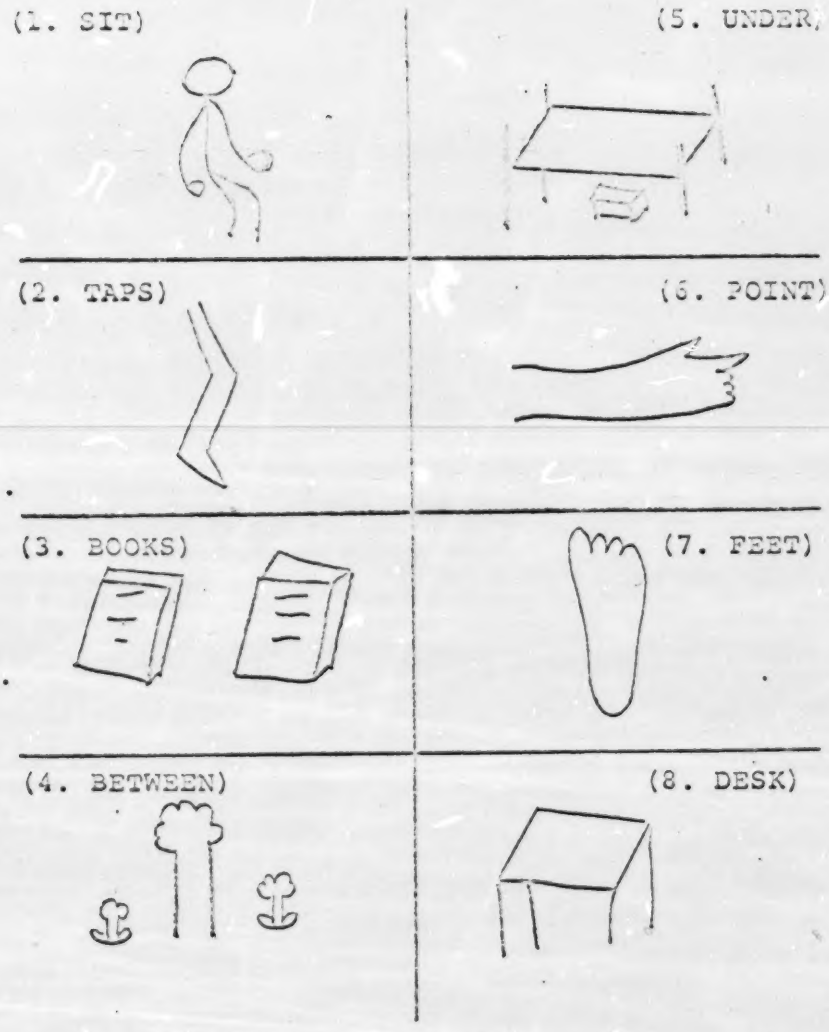

Fig. 3. Pictograph card series used on the posttest. (Words were not printed on the stimulus cards.)

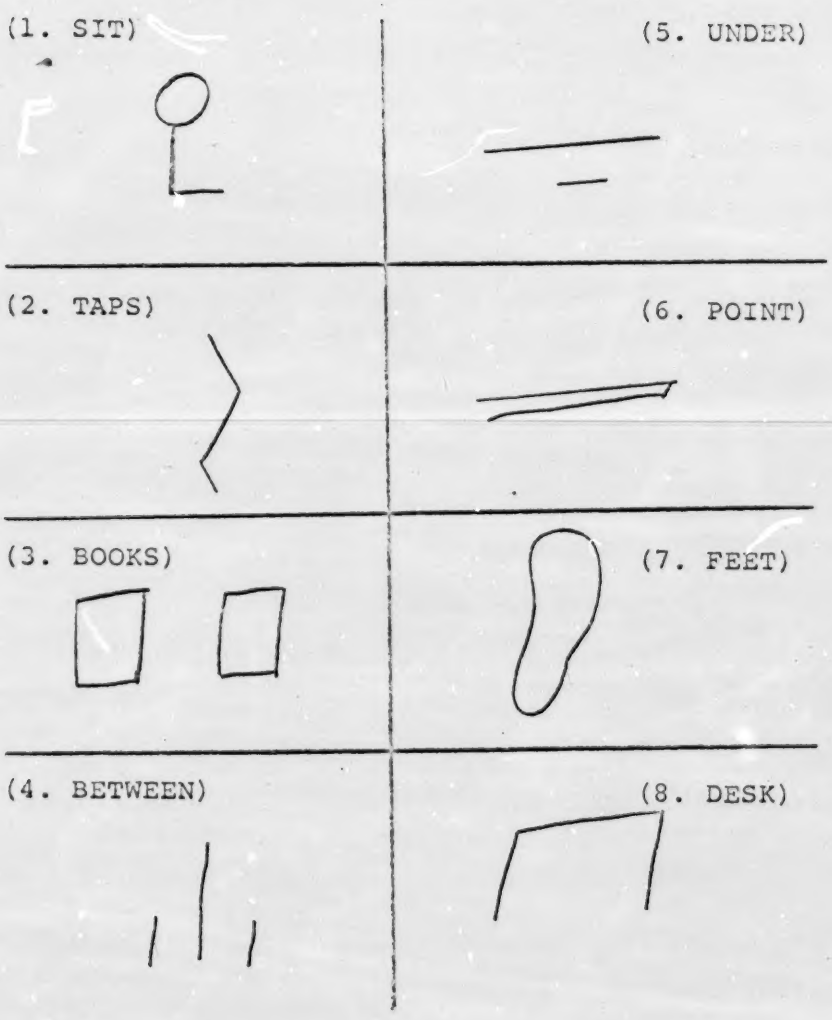

Fig. 4. Logograph card series used on the posttest. (Words were not printed on the stimulus cards.)

TABLE 1

MEAN PRE- AND POSTTEST SCORES ON A VERBAL SYNTHESIS TASK FOR 56 RANDOMLY SELECTED KINDERGARTENERS

Group	N	Synthesis scores		
		Pretest scores	Posttest scores	Gain scores
Control	15	1.33	2.40	1.07
Familiarity	13	.85	2.77*	1.92
Learning Set A	15	.73	4.26*	3.53
Learning Set B	13	1.69	4.38*	2.69

*Significant at the .05 level on the basis of the Wilcoxon Matched-Pairs Test.

TABLE 2

SCORES OF KINDERGARTEN SUBJECTS ON SYMBOL SYNTHESIS, CONTROL GROUP, CONDITION 1

Subjects	Scores			
	SS pretest (8 possible)	SS posttest (8 possible)	Gain scores	No. of prompts
1	0	0	0	9
2	1	7	6	2
3	0	1	1	4
4	0	4	4	14
5	0	0	0	2
6	0	1	1	2
7	1	4	3	1
8	1	1	0	3
9	0	2	2	8
10	1	0	-1	2
11	1	0	-1	3
12	0	0	0	0
13	1	0	-1	9
14	6	8	2	10
15	8	8	0	2

TABLE 3

SCORES OF KINDERGARTEN SUBJECTS ON SYMBOL SYNTHESIS, FAMILIARITY TRAINING, CONDITION 2

Subjects	Scores					
	SS pre-test (8 possible)	SS post-test (8 possible)	Gain scores	No. of prompts	Training 1 (6 possible)	Training 2 (6 possible)
1	1	8	7	4	3	4
2	0	1	1	3	0	1
3	6	8	2	3	4	6
4	0	8	8	0	5	6
5	0	0	0	5	0	0
6	0	0	0	6	3	0
7	2	8	6	2	5	6
8	0	0	0	5	0	0
9	0	0	0	3	0	0
10	1	1	0	3	0	0
11	0	1	1	4	0	0
12	0	0	0	5	0	0
13	1	1	0	1	0	1

TABLE 4

SCORES OF KINDERGARTEN SUBJECTS ON SYMBOL SYNTHESIS, LEARNING SET A, CONDITION 3

Subjects	Scores					
	SS pre-test (8 possible)	SS post-test (8 possible)	Gain scores	No. of prompts	Training 1 (6 possible)	Training 2 (6 possible)
1	0	5	5	5	3	6
2	0	8	8	7	4	5
3	6	8	2	5	4	6
4	0	3	3^H	4	0	4
5	0	4	4	0	0	2
6	0	1	1^H	0	3	3
7	0	5	5^H	2	4	6
8	0	0	0^H	12	0	3
9	2	8	6	0	3	5
10	0	8	8	0	5	6
11	0	8	8	2	5	6
12	0	5	5	3	1	3
13	1	0	-1^H	12	2	2
14	1	1	0^H	4	3	2
15	1	0	-1^H	14	0	4

H indicated children whose performance during training was at a higher level than performance on the post-test.

TABLE 5

SCORES OF KINDERGARTEN SUBJECTS ON SYMBOL SYNTHESIS, LEARNING SET B, CONDITION 4

Subjects	Scores						
	SS pre-test (8 pos-sible)	SS pre-test (8 pos-sible)	Gain scores	No. of prompts	Training 1 (6 possible)	Training 2 (6 possible)	Logo known
1	5	8	3	4	6	6	6
2	2	5	3^H	1	4	6	1
3	1	0	-1	4	0	0	6
4	1	0	-1^H	1	3	3	4
5	0	2	2^H	1	1	3	7
6	6	8	2	4	6	6	5
7	0	6	6	2	1	6	7
8	0	7	7	2	0	3	6
9	0	2	2^H	0	4	5	7
10	6	8	2	4	6	6	5
11	0	0	0^H	1	0	4	5
12	0	5	5^H	1	0	6	6
13	1	6	5	1	2	2	5

H indicated children whose performance during training was at a higher level than performance on the post-test.

Directions for Administering
Portion

I. Verbal Subtask

Equipment needed: two chairs, two desks.

E: "Can you walk under my hand?" (Hold hand up high.)

E: "Can you point between the chairs?"

E: "Can you tap your feet?"

E: "Can you sit at the desk?"

II. Pictograph Subtask

E: "Here are some pictures of the words you just did."

E places on the desk eight pictures in the following order:

1. sit	5. under
2. tap	6. point
3. chairs	7. feet
4. between	8. desk

E: "This is a picture of sit. Say sit. _____ Good."

E places next picture on table directly below the preceding one. "This is a picture of tap. Say tap. _____ Good."

E: "Tap" (S repeats tap, if not, prompt).

E continues for rest of words.

When all cards are displayed--

E: "Now let's see how many of these you can remember."

E points to the first card and looks at S. Give prompt if necessary. Go through all eight. At end of completed series, return to those on which prompt needed. Give three trials in all on unknown cards only. SCORE on sheet provided.

III. Logograph Subtask

E places the first logograph directly over the matching card.

E: "This means sit. Say sit."

E repeats for other words, covering cards in order.

E: "Now let's see how many of these you can remember."

E points at first card and looks at S. Give prompt if necessary. Go through all eight cards. At end of completed series, return to those on which prompt needed. Give three trials in all on unknown cards only. SCORE on sheet provided.

IV. Verbal Synthesis Subtask

E collects all cards and puts aside the pictographs. Using the logograph cards, E constructs the following "sentences," formed by overlapping the logograph cards so that a connection between the symbols is suggested.

1. Tap feet.
2. Sit between chairs.
3. Point under feet.
4. Sit under desk.
5. Tap under desk.
6. Point between feet.
7. Tap under chairs.
8. Point between chairs.

E displays first sentence and indicates with a pencil where S is to begin "reading" on the left side.

E: "Now read this." S then should read aloud. If S hesitates, E prompts and then asks S to repeat the

whole sentence. RECORD prompts needed on sheet provided.

E: "Now let me see you do it."

Do not tell subject whether he is right or wrong.

E: "Good" in a neutral, friendly voice.

E: "All right, now this one," and proceed through all eight sentences.

RECORD results on scoring sheet. Score 1 if S demonstrates the synthesized concept. RECORD action taken and comments made if the S does not promptly demonstrate the synthesis of the sentence.